Xiaolong Wu

710 N Lake Shore Drive, Chicago, IL 60611, United States

Email: xiaolongwu0713@gmail.com

Education

2020-2024   **PhD, Department of Electronic & Electrical Engineering, University of Bath, UK**

Neural engineering; Research interest: Application of stereo-electroencephalography (SEEG) for motor and speech brain-computer Interfaces.

2010-2013   **MS, Environmental and Engineering Geophysics, School of Geophysics and Information Technology, China University of Geosciences, China**

Seismic exploration; Dissertation title: "Study on the waveforms separation in the multicomponent seismic exploration"

2006-2010   **BS, School of Geophysics and Information Technology, China University of Geosciences, China**

Major in Geophysics.

Working Experience

2025-present   **Northwestern University, US**

Postdoc scholar. Postdoctoral Scholar in the Precision Neuromodulation Lab. My primary interest is the closed-loop transcranial magnetic stimulation (TMS). Primarily focus on working towards novel ways to extract the brain biomarkers from the EEG signal in real-time and personalize transcranial stimulation parameters for the best therapeutic outcome.

2023-2024   **University of Bath, UK**

Research Associate. Responsible for the dSPEECH project. This is a research project granted by EPSRC (Engineering and Physical Sciences Research Council, UK) that tries to decode speech from intracranial recordings. My responsibilities include early research, grant application, paradigm design, communication with surgeons to make sure the correct procedure defined in the paradigm will be followed, and data analysis and processing after we have collected the data.

2017-2019   **Bank of Nanjing**

Database administrator. Responsible for the maintenance of the database, including traditional Oracle database and big data platform. Ensure resiliency and availability of database services by optimizing server configuration, resource allocation, and permission control.

2015-2016   **HSBC**

IT Production support. Responsible for the maintenance of IT applications, ensuring the resiliency and availability of IT services. Monitor and investigate IT production incidents and restore customer access to services ASAP.

2013-2015   **Halliburton Co**

Field Engineer. Responsible for pre-job service design, equipment maintenance, and the installation of well-drilling products at onshore or offshore customer sites. Maintain close communication with both customers and third parties to ensure high-quality service and customer satisfaction.

Research Interests

- **Brain-computer Interfaces (BCIs).**

  I am interested in BCI, specifically motor and speech BCIs. For motor BCIs, I try to decode kinematic and kinetic information from intracranial recordings. For speech BCIs, I am interested in decoding waveform and textual representation directly from intracranial recordings.

- **Motor control and speech production.**
  Investigate how the brain controls movement and how speech is produced.

- **Closed-loop brain stimulation.**

  Closed-loop brain stimulation combining EEG and transcranial electrical and magnetic stimulation.

Research Experience

2020-2021   Decoding motor information from the Stereo-electroencephalography (SEEG) signals to control a prosthetic hand.

The SEEG data was collected from epileptic patients performing five different hand gestures in Huashan Hospital, China. Anatomic locations of electrodes distributed in various brain regions were identified and corresponding neural activities were analyzed. Very stable neural responses were identified in various regions. To classify the data into five commands, various deep learning and 'traditional' algorithms were implemented. A promising classification accuracy can be obtained using various methods, while the CNN-based deep-learning methods prevail. Further investigation showed the CNN model decoded signals mainly by extracting spectral features.

2021-2022   Decoding grasping force from the Stereo-electroencephalography (SEEG) signals.

The SEEG data was collected from epileptic patients grasping a force sensor with continuously changing amplitude in Huashan Hospital China. The anatomic locations of electrodes were identified, and corresponding neural activities were analyzed. It demonstrated that neural response in deep regions was different from that of the cortex and scalp surface. Various deep learning and 'traditional' algorithms were implemented to reconstruct the applied force. The decoded force obtained by a CNN+RNN deep learning model reflected not only the true 'rest or task' status but also the continuously changing amplitude.

2023-2024   Chinese speech waveform reconstruction from the Stereo-electroencephalography (SEEG) signals.

The SEEG data was collected from epileptic patients speaking Chinese sentences in Ruijin Hospital China. Anatomic locations of electrodes distributed in various brain regions were identified. The electrodes in various regions showed strong activities and the speech waveform can be reconstructed by advanced sequence-to-sequence models.

2023-2024   English and Chinese speech decoding from intracranial recordings

We designed a novel paradigm to study covert English speech in Southmead Hospital, Bristol UK, by aligning the EEG data to a rhythmic cue. This project aims to decode overt and covert speech.

2025-present Closed-loop brain stimulation

I am investigating the closed-loop stimulation with an electroencephalography (EEG) approach that uses real-time biosignals to track ongoing brain states and optimize the stimulation.

Publications

1.   **Wu, Xiaolong**; Jiang, Shize; Li, Guangye; Liu, Shengjie; Metcalfe, Benjamin; Chen, Liang; Zhang, Dingguo (2023): Deep Learning with Convolutional Neural Networks for Motor Brain-Computer Interfaces based on Stereo-electroencephalography (SEEG). In IEEE Journal of Biomedical and Health Informatics, pp. 1–12. DOI: 10.1109/JBHI.2023.3242262.

2.	**Wu, Xiaolong**, Dingguo Zhang, Guangye Li, Xin Gao, Benjamin Metcalfe, and Liang Chen, "Data augmentation for invasive brain-computer interfaces based on stereo-electroencephalography (SEEG)", Journal of Neural Engineering. DOI 10.1088/1741-2552/ad200e.

3.	**Xiaolong Wu**, Guangye Li, Xin Gao, Benjamin Metcalfe, Dingguo Zhang. "Channel Selection for Stereo-electroencephalography (SEEG)-based Invasive Brain-Computer Interfaces using Deep Learning Methods". IEEE Transactions on Neural Systems and Rehabilitation Engineering. DOI: 10.1109/TNSRE.2024.3364752.

4.	**Wu, Xiaolong**; Li, Guangye; Jiang, Shize; Wellington, Scott; Liu, Shengjie; Wu, Zehan et al. (2022): Decoding Continuous Kinetic Information of Grasp from Stereo-electroencephalographic (SEEG) Recordings. In JOURNAL OF NEURAL ENGINEERING. DOI: 10.1088/1741-2552/ac65b1.

5.	Liu, Shengjie; Li, Guangye; Jiang, Shize; **Wu, Xiaolong**; Hu, Jie; Zhang, Dingguo; Chen, Liang (2021): Investigating Data Cleaning Methods to Improve Performance of Brain-Computer Interfaces Based on Stereo-Electroencephalography. In FRONTIERS IN NEUROSCIENCE 15. DOI: 10.3389/fnins.2021.725384.

6.	**X. Wu**, B. Metcalfe, S. He, H. Tan and D. Zhang, "A Review of Motor Brain-Computer Interfaces Using Intracranial Electroencephalography Based on Surface Electrodes and Depth Electrodes," IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 32, pp. 2408-2431, 2024, doi: 10.1109/TNSRE.2024.3421551.

7.	**Xiaolong Wu**; Scott Wellington; Zhichun Fu; Dingguo Zhang (2024): Speech decoding from stereo-electroencephalography (sEEG) signals using advanced deep learning methods. JOURNAL OF NEURAL ENGINEERING 21 (3), p. 36055. DOI: 10.1088/1741-2552/ad593a.

8.	Xin Gao; Kai Gui; **Xiaolong Wu**; Benjamin Metcalfe; Dingguo Zhang, "Effects of Different Preprocessing Pipelines on Motor Imagery-Based Brain-Computer Interfaces," in *IEEE Journal of Biomedical and Health Informatics*, vol. 29, no. 5, pp. 3343-3355, May 2025, doi: 10.1109/JBHI.2025.3532771.

Presentation

1,	Oral Presentation at 2023 China Biomedical Engineering Conference & Medical Innovation Summit (BME2023), Suzhou, China. Topic: "Channel selection in high throughput invasive Brain-computer-interface (BCI)".

2,	Poster Presentation at 7th International Conference on Neuroinformation, Chengdu, China. Topic: "Decoding grasping force from stereo-electroencephalographic (SEEG) recordings".

Honours and Awards

2006	Second Prize in Professional Courses, China University of Geosciences, Beijing, China

2023	Doctoral Recognition Awards, University of Bath, UK

Teaching and supervision

2020-2023 Supervise final year project of postgraduate students, University of Bath, UK

2020-2023 Casual demonstrators for postgraduate students, University of Bath, UK

2017-2018 STEM innovation workshop for kids (6 years old and above), Shanghai, China

Transferable Skills

Teamwork & Communication

- As a field engineer at Halliburton, I worked closely with our customers and other third parties to ensure all procedures were completed in an orderly and timely manner, while at the same time promoting good customer relations at the customer site and ensuring customer satisfaction. In such a high-risk work environment, all instructions must be communicated accurately and promptly.

- In my three PhD projects, I maintained close relationships with three hospitals (Huashan and Ruijin Hospital in Shanghai, China, and Southmead Hospital, Bristol, UK). In each of these projects, as the sole responsible person, I had to make sure the research proposal was flawless and fully understood by the neurosurgeon. To ensure the experiment paradigm is feasible in the ward environment and is accurately followed by the surgeons, close communication and timely feedback are critical during the dry run and the actual data collection.

Adaptivity

- I am a fast learner and capable of acquiring the required skills quickly in a new field. I majored in seismic exploration in college, while in my first job as a field engineer at Halliburton, I learned well-drilling procedures and maintained heavy and complex mechanical instruments. Two years later, I joined the IT infrastructure team at HSBC responsible for IT services and database maintenance. However, I always have had a passion for neural engineering. To pursue my ambition, I mastered basic neuroscience knowledge and various algorithms, especially deep learning methods, during my PhD study.

IT skills

- Linux system, python, MATLAB, Psychtoolbox, PyTorch, TensorFlow, Microsoft Office, Adobe Illustrator, EEG software (MNE, EEGlab).

Academic service

Peer reviewer for Journal of Neural Engineering, IEEE Transactions on Neural System and Rehabilitation Engineering, IEEE Transactions on Biomedical Engineering (TBME).

Referees

Will be provided on request.